Congress of the United States
House of Representatives
Washington, DC 20515

March 31, 2023

The Honorable Mike Simpson
Subcommittee on Energy and Water Development
Committee on Appropriations
2362-B Rayburn House Office Building
Washington, D.C. 20515

The Honorable Marcy Kaptur
Subcommittee on Energy and Water Development
Committee on Appropriations
1016 Longworth House Office Building
Washington, D.C. 20515

Dear Chairman Fleischmann and Ranking Member Kaptur;

We write in support of the Department of Energy (DOE) and National Nuclear Security Administration's (NNSA) Inertial Confinement Fusion (ICF) program. As you develop the fiscal year 2024 (FY24) Energy and Water Development, and Related Agencies Appropriations bill we ask for your continued support and specifically request that you provide $685,000,000 for the ICF program and allocate $42,000,000 within that amount for target production.

The NNSA's ICF program maintains three unique, world-leading science facilities, the National Ignition Facility (NIF) at Lawrence Livermore National Laboratory (LLNL), the Z Pulsed Power Facility (Z) at Sandia National Laboratories, and the Omega Laser Facility (OMEGA) at the University of Rochester's Laboratory for Laser Energetics (LLE). These three complementary facilities are the Nation's only capability for studying high-energy-density (HED) science on macroscopic scales. In addition, the Los Alamos National Laboratory contributes novel approaches towards fusion ignition, and the complex targets needed for every experiment are developed and fabricated by General Atomics. Target quality and innovation continue to be a significant contributor to advances in performance in the three major ICF facilities.

The ICF program is an integral part of the science-based Stockpile Stewardship and Management Program (SSMP) specifically developed to maintain a safe, secure and effective deterrent following the voluntary cessation of underground nuclear testing in the early 1990's. Ninety-nine percent of the yield from U.S. weapons occurs under HED conditions. Laboratory based ICF

research allows scientists to create and better understand materials in the HED state, generating critical experimental data and providing the U.S. with insights into the least understood aspects of operational nuclear weapons. Without underground testing, ICF research is the only way to improve understanding of specific aspects of weapons performance, weapon effects, and nuclear survivability within our current stockpile.

ICF experiments generate much more than useful data. They also train and test the judgment of the scientists called upon annually to certify the safety of the current stockpile. These same scientists are also the experts called upon to evaluate the capabilities of our adversaries. Through a steady focus on achieving ignition and controlled fusion in the laboratory, a grand scientific and engineering challenge for the 21st century, the ICF program serves as a magnet for recruiting the next-generation of highly skilled scientists and engineers. Many leaders in the nuclear security workforce began their careers in the ICF program. Continued support for the ICF program will strengthen the national security workforce pipeline and provide confidence to researchers considering a career in these fields.

Thanks to investment by the NNSA and DOE, the United States is currently the world leader in ICF and HED science. On December 5, 2022, the NIF's 192 laser beams delivered 2.05 megajoules (MJ) of energy to implode a small pellet of fuel and produced 3.15 MJ of fusion energy, demonstrating fusion ignition for the first time ever in a laboratory setting. The achievement of fusion ignition was a 60-year-long journey that would not have been possible without the sustained support of Congress. Throughout the effort, LLNL staff and the ICF community worked together effectively to overcome major hurdles – ultimately seven technological "miracles" were required. Important breakthroughs that ultimately led to success include innovations in target design, advancements in precision fabrication of targets, state-of-the-art diagnostics, simulation modeling aided by artificial intelligence, and optical switches, deformable mirrors, and high-power laser glass that enabled experiments at higher levels of laser energy and power. These advances have found application in many additional endeavors.

The achievement of ignition, and decade of advances in HED science underlying it, clearly demonstrate current U.S. leadership in ICF science and technology which supports our deterrent stewardship and modernization efforts. However, continued investment is needed to maintain U.S. leadership as other countries are investing significantly in their research capabilities and nuclear force modernization programs. Russia and China are building facilities that would rival or exceed the size and capabilities of the NIF and Z. These facilities are expected to become operational in the next several years. If Russia or China gained regular access to advanced fusion before the U.S., it would cede long-held U.S. technological superiority. Now is the time to build on our scientific leadership and increase the momentum in the program as the next several years will see a significant increase in demand on the use of the new capability in support of NNSA's mission.

This viewpoint is substantiated by two recent independent reviews of the ICF program. In an April 2021 report, the JASONs Defense Advisory Panel concluded that "stockpile stewardship has derived significant benefit from the ICF program" and the program has even been able to address issues "that were not foreseen when today's facilities were designed and built, including development of new diagnostics." The report further highlights that these "world-leading facilities attract early-career-scientific and engineers, who gain hands-on experience, judgement, and international credibility" and that "U.S. stockpile stewardship will rely on NIF, OMEGA, and the Z machine into the 2030s." However, "these facilities will require maintenance and upgrades, along with enhanced diagnostics, if they are to continue supplying the information on which stewardship has come to rely." This study pointed out the challenge of achieving ignition, yet less than two years later the U.S. demonstrated it could be done. More recently, in February 2023, the National Academy of Sciences completed its report on Fundamental Research in High Energy Density Science. One of its leading recommendations is that "NNSA should exploit and enhance the capabilities of its flagship HED facilities" [NIF, OMEGA, and Z] by establishing plans over the next 5 years" for "extending, upgrading, or replacing those facilities" to "strengthen its global leadership in [HED] science and address future national needs."

The FY24 request of $685,000,000 includes funding to address the recommendations of the JASONs ICF and NAS HED science reports. This includes additional investments in creating a robust fusion yield, all three approaches to ignition, new diagnostics, and technologies for next-generation laser and pulsed power facilities. The request also includes additional funding for targets—the small pellets of fuel needed for all ICF experiments—to support continued target research and development, as well as the manufacturing of the increasingly innovative and complex targets required to meet the needs of the ICF program.

Additionally, the request includes $70,000,000 in funding for essential sustainment activities for the ICF facilities. With increasing needs due to an aging and evolving nuclear stockpile, evolving threats to our nuclear deterrent, and expanding interest for fundamental discovery in HED science, the demand on these ICF facilities continues to grow. However, all three facilities are aging and have not had major infrastructure investments since they were refurbished or constructed in the 2000s. The ICF facilities have already identified more than $650,000,000 in sustainment needs over the next 5 to 10 years. While NNSA is still finalizing a congressionally directed strategic plan for recapitalizing, upgrading, and maintaining ICF facilities, further delays to recapitalizing these facilities will impact their ability to conduct experiments and support NNSA stockpile stewardship mission requirements. These facilities were developed to replicate environments only achievable in underground nuclear explosions which they have been doing successfully since 1992; sustainment is needed to make sure these world leading facilities are available for the next tens of years.

While the ICF program is essential for the stockpile stewardship mission, the ICF program has also contributed to other international scientific and technological discoveries. For instance, the NNSA funded the research that led to the discovery of Chirped-Pulse Amplification

(CPA) at LLE. This important breakthrough enabled a revolutionary increase in laser power and was recognized with the 2018 Nobel Prize in Physics. CPA is the basis of all modern ultra-highpower lasers and has enabled a variety of applications, from advanced materials processing, including manufacturing glass for smart-phone screens, to LASIK eye surgery. Another example is early work on X-ray lasers conducted at LLNL that lead to the development of Extreme Ultraviolet Lithography (EUV). First commercialized in 2017, EUV is now the basis for state-of the-art in semiconductor manufacturing and enables a huge step forward in microchip processing power through increasing miniaturization. The majority of the ongoing programs in laser-based directed-energy have roots in the ICF program. ICF program scientists are also currently playing a leading role in efforts to restore U.S. leadership in high intensity laser research and development with broad applications in medical technologies, advanced microelectronics and material processing, quantum information science, and fusion energy.

It is because the ICF program makes vitally important contributions to our national and economic security that we thank you for your past support and ask that you provide appropriations of $685,000,000, including $42,000,000 for target production, for the NNSA's ICF program in the FY24 Energy and Water Development, and Related Agencies Appropriations bill.

Sincerely,

Joseph D. Morelle
Member of Congress

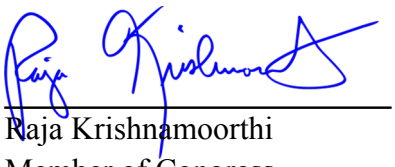
Eric Swalwell
Member of Congress

Zoe Lofgren
Member of Congress

Rick Larsen
Member of Congress

Bill Foster
Member of Congress

Scott H. Peters
Member of Congress



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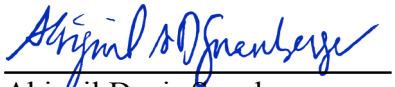

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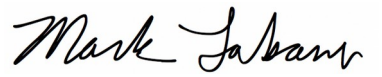

MARK TAKANO
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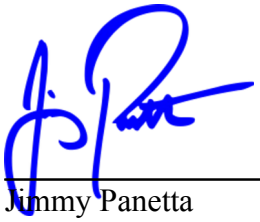

Jimmy Panetta
Member of Congress